Constellation-X
Project Scientist Report

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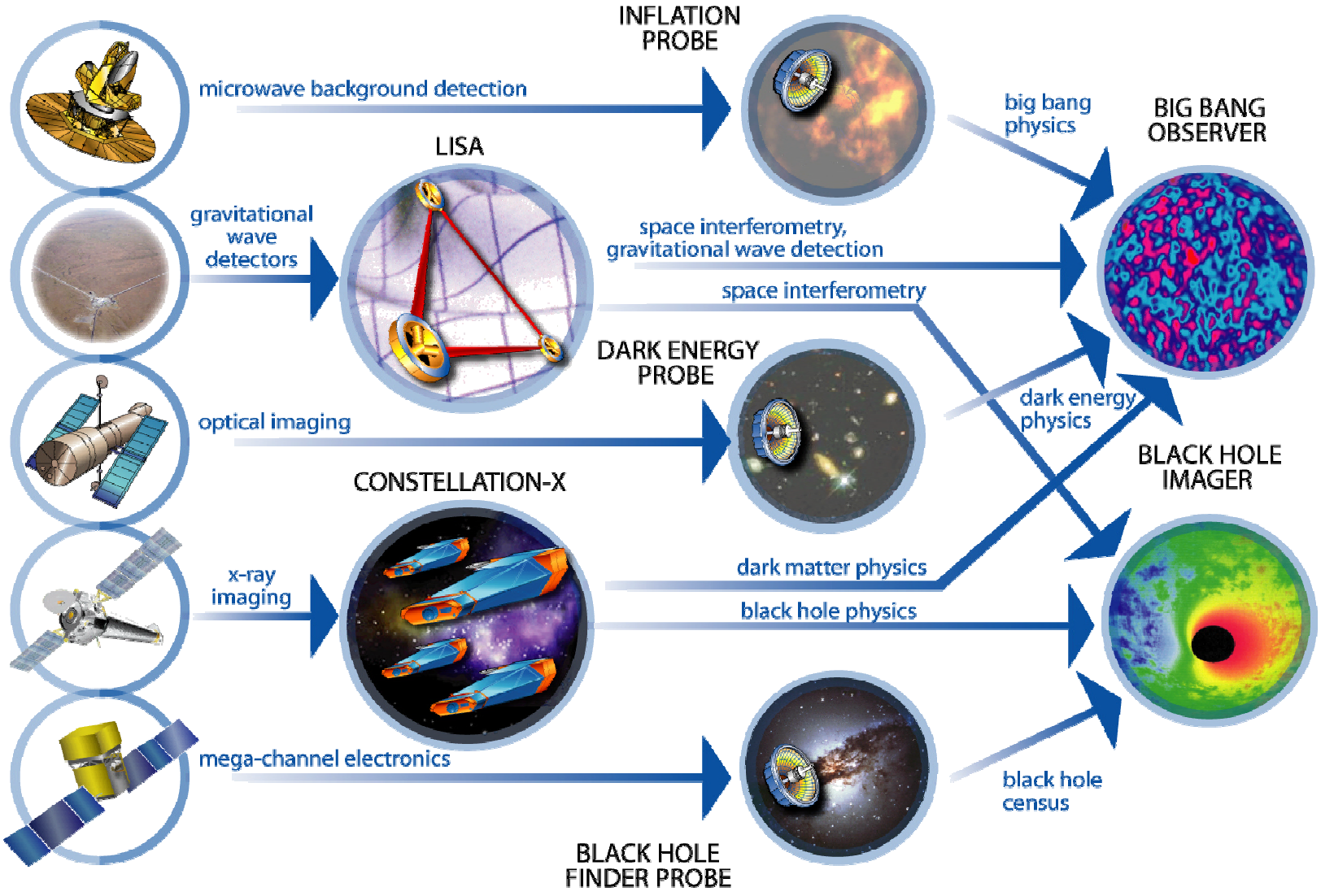
GSFC

Beyond Einstein Program

Science and Technology Precursors



Constellation-X

Use X-ray spectroscopy to observe

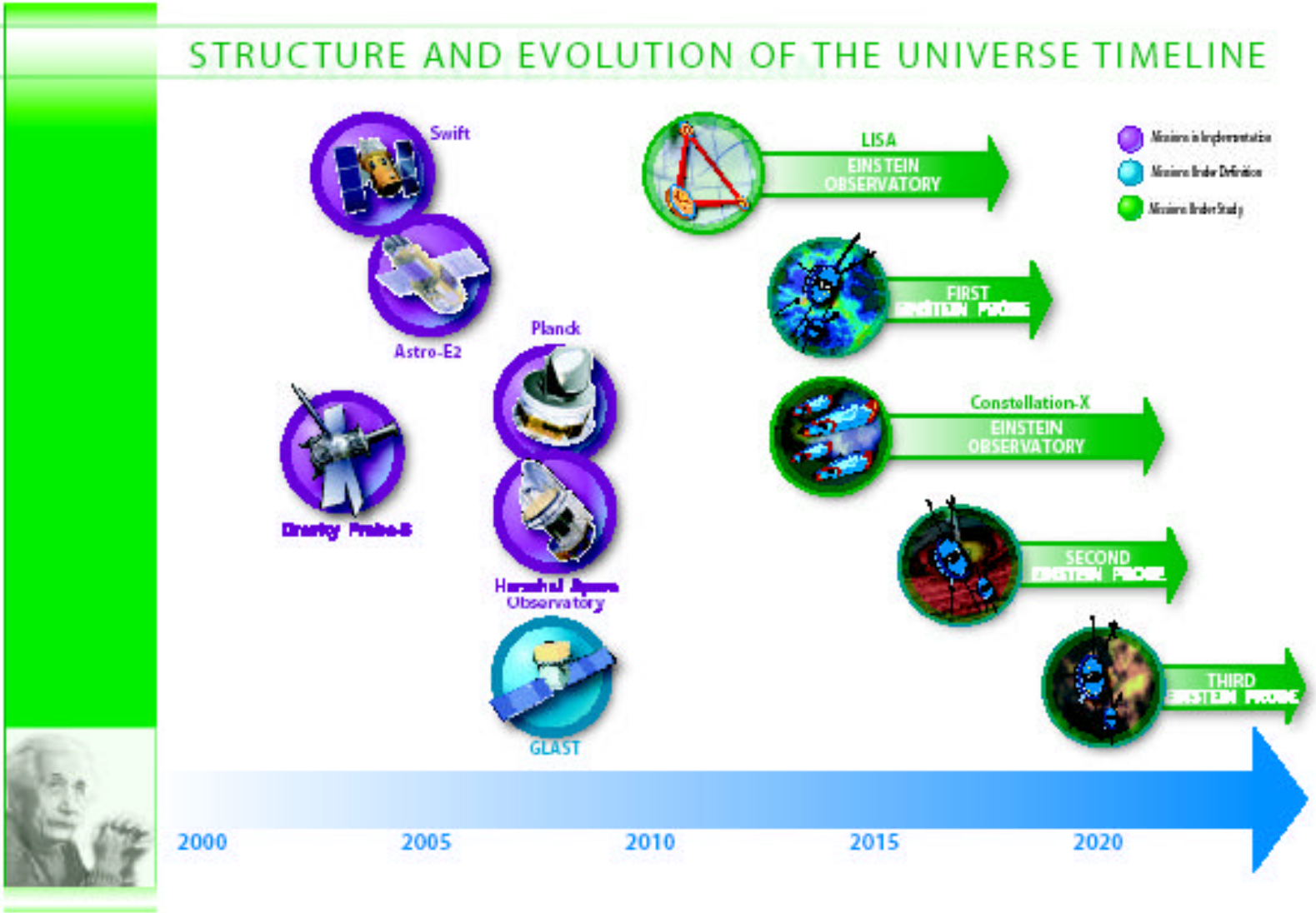
- **Black holes:**
  - **Probe close to the event horizon**
  - **Evolution with redshift**
- **Dark side of the Universe:**
  - **Clusters of galaxies and large-scale structure**
- **Production and recycling of the elements:**
  - **Supernovae and interstellar medium**

- **25-100 times sensitivity gain for high resolution spectroscopy in the 0.25 to 10 keV band**
- **Four satellites at L2 operating as one with advanced X-ray spectrometers**

Enable high resolution spectroscopy of faint X-ray sources

Constellation-X given strong endorsement by US National Academy of Sciences McKee-Taylor and Turner Committee Reports

STRUCTURE AND EVOLUTION OF THE UNIVERSE TIMELINE



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Constellation-X Status

Constellation-X is fully funded & approved in the NASA FY04 budget!!

- part of Beyond Einstein Program
- still waiting for Congress to pass the budget

Con-X Project is now starting phase A (once budget is passed)

The HQ run independent Technology Readiness and Implementation Plan Review (TRIP) in March 2003

- rated the mission a “low risk” (when the first launch is in 2012)

Planned launch dates are ~ 2013/14

Excellent progress on the technology

- moving steadily to achieve required technology readiness levels

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Constellation-X Progress

- Recent Highlights:
  - Optical Alignment Pathfinder Unit #2 test at MSFC is underway
  - Produced 50-cm reflectors to near-flight specs
  - Completed 4-stage ADR
  - Operating 2x8 TES array in an ADR platform
  - SXT industry study procurement kicked off

- Plans for FY04
  - Design and construct the SXT Engineering Unit
  - Fabricate 8x8 array and achieve 2x8 readout demo unit for XMS
  - X-ray, environmental test and downselect for nickel/glass optics for HXT
  - In-plane/off-plane gratings trade; fabrication of 3-grating module
  - Begin our mirror technology transfer to our industrial partners through the SXT industry study contracts
  - Staff-up Project for major Phase A activities—procurements, independent reviews, reporting and management processes

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International Participation in Con-X

International participation is desirable to reduce both cost to NASA and mission risk (by bringing new technologies)

Inter-agency collaboration is a hallmark of Beyond Einstein
LISA (ESA/NASA), Dark Energy Probe (NASA/DOE)

Phase A (now) is the time to consider international contributions that might impact the Con-X mission design

Science enhancement possible, especially towards achieving mission science goals (e.g. 5 arc sec), but must NOT:

- erode Con-X science requirements
- increase mission risk or impact the schedule

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International Participation: Small Contributions

- Participate in Constellation-X instrument AO, expected in ~2005
  - Outcome depends on peer reviewed competition
- Minimal impact, no action required beyond starting discussions with prospective proposers
- Risk: Proposals with international partners may not be selected

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International Participation: Medium Contributions

- Provide guaranteed contribution to the mission
- Example contributions:
  - mandrels for SXT
  - part of an instrument or SXT (especially where partner has unique technological contribution)
- *Guaranteed instrument contribution:* need to establish before the instrument AO in 2005
- *SXT contribution:* would need agreement by 2006

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International Participation: Large Contributions

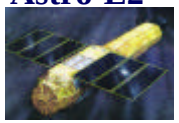
- Large contribution would consist of:
  - Substantial part of optics (SXT)
  - Substantial part of mission (e.g. s/c or launch)
  - An instrument
- Given long timescale to get agency approvals, should start work on this now if there is interest

X-ray Astronomy Roadmap

Chandra

XMM-Newton

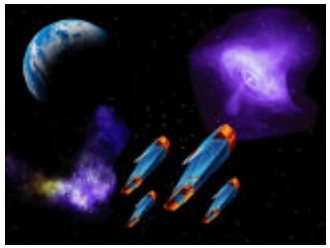
Astro-E2



0.1-0.35 m^2
0.5-90 arc sec

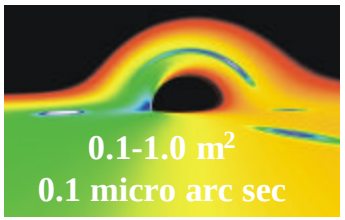
Constellation-X

20-100 times sensitivity for R ~ 300-3000



3 m^2
5-15 arc sec

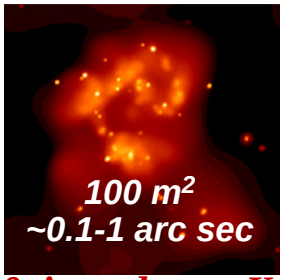
MAXIM



10 Million times finer imaging

Black Hole Event horizon

Generation-X



1000 times deeper X-ray imaging

First black holes

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Conclusions

- The Constellation-X mission is fully approved & funded, as part of Beyond Einstein
- Technology progress is excellent and getting very close to meeting required mission performance
- TRIP review finds the mission low risk
- Now is the time to investigate international contributions
  - It would be beneficial if we can develop an integrated International X-ray Astronomy Plan